Data Distribution Management Services (DDMS) Technical Exchange

August 1996

Purpose and Topics

- **Purpose**
  - **Provide introductory context for HLA technical exchange on data distribution management services (DDMS) in conjunction with AMG-14**
- **Topics**
  - **Background: what are DDMS and where did they come from?**
  - **Declaration management and data distribution management compared**
  - **DDMS Concepts**
  - **Role of the Federate in DDMS**
  - **Role of the RTI in DDMS**

Data Distribution Management Services

- DDMS are a sixth service group in the HLA Interface Specification Version 1.0
  - one of the issues for HLA is the ability to support large federations
  - experiments were undertaken to investigate the applicability of realtime scalability techniques in the HLA
  - these techniques were initiated as part of the DARPA RITN program have been implemented in STOW-E and in JPSD experiments
- An extension to the interface specification was created and an experimental version of the RTI (0.33e) was implemented and used at IEC
- Results as reported by the DM group (Seidensticker, lead) were
  - Current API is workable; it has been implemented and used
  - This API can be used to support various distribution schemes; analysis done by IEC
  - Current implementation does reduce network load; initial simulation-based results by IEC

Declaration Management and Data Distribution Management

- **Current DDMS were orginally viewed as part of Delaration Management Services, however independent review found them to be different in kind and separated them**
  - **Delaration Management Services**
    - **allow federates to specify by class and attribute name and by interaction class, the types of data they will send or receive**
    - **bound by the classes and attributes in the FOM**
  - **Data Distribution Management Services**
    - **allow federates to specify the distribution conditions for the specific data they are sending or expect to receive**
    - **not bound by FOM, data distribution can be managed based on other characteristics of objects important to particular federation execution**

Basic HLA DDMS Concepts

- **The fundamental concept underlying data distribution management is *routing spaces*.**
- **A routing space is a multidimensional coordinate system in which federates express an interest for either receiving data or sending data**
- **Routing spaces are designed by federations to meet the needs of their particular federation execution**
  - **To use routing spaces, each federation defines the allowable routing spaces for the federation execution, including the dimensions (variables) of the routing space.**
  - **Routing spaces are then initialized in the RID with a name and the number of dimensions**

Using DDMS: The Role of the Federate

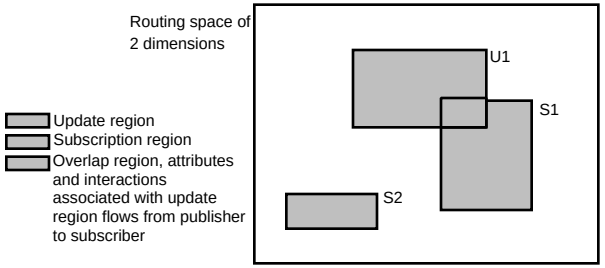
- **Each federate decides which of the federation routing spaces are useful to them**
  - **defines the portions of those routing spaces that specify (from the federate's perspective) the logical areas of interest particular to the federate, these are called *regions***
    - **these are defined by putting bounds (or *extents*) on the dimensions of the selected routing space.**
- **The federate then uses these regions**
  - **to specify conditions (`Create Subscription Region`) under which they expect to receive the object state data and interactions they specified using declaration management services (`Subscribe Object Class Attribute and Subscribe Interaction Class`) and**
  - **to specify conditions under which they are providing data (`Create Update Region and Associate Update Region`).**

Using DDMS: The Responsibilities of the Federate

- **Specifying a subscription region (`Create Subscription Region`)**
  - **the federate tells the RTI to only deliver data which fall within the bounds (extents) of the region specified by that federate**
- **Specifying an update region and associating that update region with a particular object instance (`Create Update Region and Associate Update Region`)**
  - **the federate ensures that the characteristics of the object instance or interaction which map to the dimensions of the routing space fall within the bounds (extents) of the associated region at the time that the attribute update or send interaction call is issued**
  - **the federate monitors these added characteristics for each of the attributes owned by the federate**
  - **as the state of the objects change, the federate may need to either adjust the bounds on the associated regions (`Modify Region`) or change the association to another region (`Associate Update Region`)**

The Role of the RTI in DDMS

- **The routing space, regions, and association data is used by the RTI to distribute data**
- **When an update region and subscription regions of different federates overlap,**
  - **the RTI ensures that the attribute updates and interactions associated with that update region are routed to federates with subscription regions which overlap the sender's update region**
- **The RTI provides feedback to federate (`Change thresholds`) on the amount of change in extents which will lead to data distribution changes**



Relationship Between FOM Classes and Attributes and Routing Space Dimensions

- The dimensions of routing spaces need not necessarily map to attributes in the FOM
- DDMS provide a federation the capability to specify data distribution on characteristics of objects other than those exchanged as part of federation execution
- By specifying routing spaces and regions using attributes specified in the FOM,
  - the DDMS provide a mechanism to control data distribution based on values of attributes